

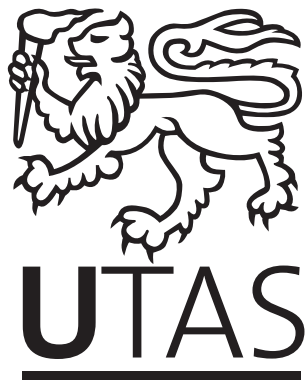
A DAILY TAG RETURN MODEL FOR LOBSTER FISHERIES

by

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Doctor of Philosophy in Quantitative Marine Science
(A joint CSIRO and UTAS PhD program in quantitative marine science)

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I declare that this thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the thesis, and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due acknowledgement is made in the text of the thesis.

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Statement of Co-Authorship

The following people and institutions contributed to the publication of the work undertaken as part of this thesis (Chapter 7):

A modelled cost-benefit analysis of hybrid PIT and conventional tagging scenarios, *New Zealand Journal of Marine and Freshwater Research*, 2009, Vol 43, 339–346.

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ABSTRACT

A daily tag return model was developed to estimate fishing and natural mortality, tag reporting rate and catchability with application to lobster fisheries. Tag return data is usually collected with knowledge of the exact date of recapture. By modelling tags individually, each tag contributes information on fishing and natural mortality, catchability and tag reporting rate to the likelihood. Providing sufficient tags are maintained in the fishery to enable recaptures to occur during the fishing season, finer resolution of parameters is possible.

Model performance was tested by simulation of different times of release and recapture as well as a range of different seasonal fishing patterns typically found in lobster fisheries. Precision and accuracy of estimates were improved when there was a contrast in fishing effort throughout the season or a seasonal closure within the year. The timing of tag release was not found to affect model performance.

Evaluation of the model was undertaken by comparison of estimates from a previous study using an identical dataset. Total mortality estimates were equivalent between models although separation of fishing and natural mortality differed between models. Small improvements in the precision of estimates were obtained for the model that incorporated exact times of tag release and recapture.

The daily model enabled finer time scale estimates of parameters and this was explored in the estimate of within season catchability. Penalised spline smoothing was applied to estimate catchability, resulting in a curve that captured the timing of biological events such as moulting and mating.

Higher fishing mortality estimates were obtained when the fishing fleet was separated into groups based on their reliability at returning tags. This suggests that fishing mortality estimates could be compromised when reporting rate is considered cosmopolitan across the entire fleet. However, the small number of reliable fishers and their fishing patterns, make interpretation of results problematic.

A cost-benefit analysis of the use of PIT tags compared to T-bar tags, the standard tag used in lobster fisheries, was undertaken. For a given cost the higher expenses associated with PIT tags and scanners resulted in fewer lobster being tagged compared to T-bar tags. The improved tag reporting rate from PIT tags resulted in improved precision and accuracy of mortality estimates using this technology unless the tag reporting rate for T-bar tags was substantially increased.

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TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF TABLES	vi
LIST OF FIGURES	vii
1 INTRODUCTION	1
1.1 Why Tag?	1
1.1.1 Tagging for Estimation of Demographic Parameters	2
1.1.2 Brownie Models	3
1.1.3 Continuous Time Models	4
1.1.4 Tasmanian Rock Lobster Fishery	4
1.2 Aims of this Thesis	5
1.2.1 Chapter 2: Development of the Survival Model	5
1.2.2 Chapter 3: Validation of the Model	5
1.2.3 Chapter 4: Application of the Model to a Tasmanian Fishery	5
1.2.4 Chapter 5: Fine Time-Scale Catchability	6
1.2.5 Chapter 6: PIT Tags and Trusted Fishers	6
1.2.6 Chapter 7: Cost Benefit Analysis of Hybrid PIT and Conventional Tagging Scenarios	6
1.2.7 Chapter 8: Conclusions and Discussion	6
2 MODEL DEVELOPMENT	7
2.1 Introduction	7
2.1.1 Survival Analysis	7
2.1.2 The Survival Function	8
2.2 Model Assumptions	8

TABLE OF CONTENTS

ii

2.2.1	Representative Sample	9
2.2.2	Independence of Recaptures	10
2.2.3	Emigration	10
2.2.4	Independence of Fishing and Natural Mortality	10
2.2.5	Tag Loss and Tag Induced Mortality	11
2.3	Model Development	11
2.3.1	Likelihood	12
2.4	Parametrisation	15
2.4.1	Basic Models	15
2.4.2	Gender	16
2.4.3	Fishing Effort	16
2.4.4	Tag Induced Mortality	16
2.5	Estimation	17
2.5.1	Maximum Likelihood	17
2.5.2	Likelihood Ratio Tests	17
2.5.3	Akaike's Information Criteria	18
2.5.4	Profile Likelihood	18
2.5.5	Piecewise Approximation	18
2.5.6	Numerical Minimisation	20
2.6	Summary	21
3	MODEL VALIDATION	22
3.1	Introduction	22
3.2	Methods and Assumptions Applied to All Models	22
3.3	Complete Reporting	22
3.3.1	Results	23
3.3.2	Discussion	24
3.4	Tag Reporting Rate	31
3.4.1	Results	31
3.4.2	Discussion	31
3.5	Release Patterns	33
3.5.1	Results	34
3.5.2	Discussion	35

3.6	Australian Lobster Fisheries	35
3.6.1	Results	36
3.6.2	Discussion	36
3.7	Conclusions and Discussion	38
4	APPLICATION OF THE MODEL	39
4.1	Introduction	39
4.1.1	Background	39
4.1.2	Previous Research	43
4.2	Methods and Models	44
4.2.1	Model Assumptions	44
4.2.2	Proposed Models	44
4.2.3	Evaluation of Candidate Models	48
4.3	Results	48
4.4	Discussion	55
5	FINE TIMESCALE CATCHABILITY	58
5.1	Introduction	58
5.1.1	Biological Variation of the Southern Rock Lobster	59
5.2	Smoothing	60
5.2.1	Basis Smoothing	60
5.2.2	Penalty Smoothing	60
5.2.3	Hybrid Approach	62
5.2.4	Selecting α and Cross-Validation	62
5.3	Application to King Island Data	62
5.3.1	Fourier Representation of Catchability	62
5.4	Results	63
5.5	Discussion	65
6	IMPROVING REPORTING RATE	68
6.1	Introduction	68
6.2	Methods and Models	71
6.2.1	Model Development—Multiple Fleets	71
6.2.2	Piecewise Approximation	73

6.3	Testing the Multiple Fishing Component Model	74
6.3.1	Hybrid PIT Tags	74
6.3.2	Trusted Fishers and Research Fishing	75
6.4	Results	75
6.4.1	Hybrid PIT Tags	75
6.4.2	Trusted Fishers and Research Fishing	77
6.5	Discussion	82
7	COST BENEFIT ANALYSIS	85
7.1	Abstract	85
7.2	Introduction	86
7.3	Methods	87
7.3.1	The Model	87
7.3.2	Simulation	88
7.3.3	Tagging at the Beginning of the Fishing Season	89
7.4	Results	89
7.5	Discussion	92
7.6	Acknowledgments	94
8	FINAL CONCLUSIONS	95
8.1	Model Performance	95
8.2	Comparison with Brownie	95
8.3	Tag Reporting Rate	96
8.4	Variable Catchability	96
8.5	Further Work	97
8.6	Final Conclusions	97
A	BROWNIE MODELS	99
A.1	Development of the Brownie Model	99
A.1.1	Expected Values	100
A.1.2	Likelihood Function	100
A.1.3	Model Assumptions	101
B	DERIVATION OF THE GRADIENT	102

TABLE OF CONTENTS

v

B.1	Likelihood	102
B.2	Single Component Fishery	102
B.2.1	Recovered Tags	103
B.2.2	Censored Tags	103
B.3	Multiple Component Fishery	104
B.3.1	Recovered Tags	104
B.3.2	Censored Tags	105
BIBLIOGRAPHY		106